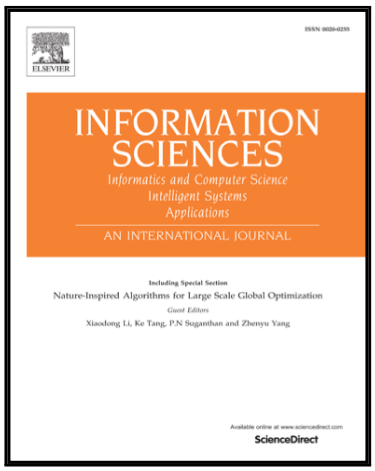

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Adaptive control for switched nonlinear systems with coupled input nonlinearities and state constraints

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Abstract

This paper focuses on the trajectory tracking problem for switched non-strict feedback nonlinear systems with arbitrary switching. Difficulties exist because coupled input nonlinearities and full state time-varying constraints. To solve this problem, we propose a new adaptive backstepping control strategy. This strategy has three distinguishing features: 1) Based on the concept of *novel $\mathcal{F}$-class functions*, the proposed adaptive control strategy can deal with many input nonlinearities, including coupled unknown time-varying and state-dependent input nonlinearities. 2) By using a new *system transformation technique*, the proposed adaptive control method is suitable for very general systems, i.e., non-strict feedback nonlinear systems with arbitrary switching and time-varying state constraints. 3) The "explosion of complexity" problem in traditional backstepping design is avoided by using the approximation capability of fuzzy logic. It turns out that the proposed controller contains only *one adaptive parameter*. Practical examples are provided to illustrate the effectiveness of the proposed method.

Keywords:
adaptive backstepping control, full state constraints, switched systems, coupled input nonlinearties, fuzzy logic systems.

1. Introduction

Switched systems, a special class of hybrid systems, have received considerable attention from both academic and industrial points of view [7, 18, 20, 51]. Switched systems contain a family of subsystems and a switching law defining the active time of the specified subsystem. Many engineering systems, such as mechanical systems, networked control systems, electric power systems etc., can be well described by switched systems [19, 26]. Recently, stability analysis and controller synthesis for switched systems have become two hot topics [22, 24, 40, 44]. Many excellent results have been obtained for various classes

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